24 Port 10/100Mbps Switch

FMS-24K

PLANEX COMMUNICATIONS INC.

Installation Guide

24-Port Fast Ethernet Switch

Intelligent Fast Ethernet Switch
with 24 10BASE-T / 100BASE-TX (RJ-45) Ports,
and 2 Slots for 100BASE-FX or Gigabit Uplink Modules

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Compliances

FCC - Class A

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart B of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference. You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

You may use unshielded twisted-pair (UTP) for RJ-45 connections - Category 3 or greater for 10 Mbps connections, Category 5 for 100 Mbps connections, Category 5, 5e, or 6 for 1000 Mbps connections. For fiber optic connections, you may use 50/125 or 62.5/125 micron multimode fiber or 9/125 micron single-mode fiber.

Warnings: 1. Wear an anti-static wrist strap or take other suitable measures to prevent electrostatic discharge when handling this equipment.

2. When connecting this hub to a power outlet, connect the field ground lead on the tri-pole power plug to a valid earth ground line to prevent electrical hazards.

Industry Canada - Class A

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled “Digital Apparatus,” ICES-003 of the Department of Communications.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: “Appareils Numériques,” NMB-003 édictée par le ministère des Communications.

Japan VCCI Class A

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

CE Mark Declaration of Conformance for EMI and Safety (EEC)

This information technology equipment complies with the requirements of the Council Directive 89/336/EEC on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility and 73/23/EEC for electrical equipment used within certain voltage limits and the Amendment Directive 93/68/EEC. For the evaluation of the compliance with these Directives, the following standards were applied:

RFI Emission:
- Limit class A according to EN 55022:1998
- Limit class A for harmonic current emission according to EN 61000-3-2/1995
- Limitation of voltage fluctuation and flicker in low-voltage supply system according to EN 61000-3-3/1995

Immunity:
- Product family standard according to EN 55024:1998
- Electrostatic Discharge according to EN 61000-4-2:1995 (Contact Discharge: ±4 kV, Air Discharge: ±8 kV)
- Radio-frequency electromagnetic field according to EN 61000-4-3:1996 (80 - 1000 MHz with 1 kHz AM 80% Modulation: 3 V/m)
- Electrical fast transient/burst according to EN 61000-4-4:1995 (AC/DC power supply: ±1 kV, Data/Signal lines: ±0.5 kV)
- Surge immunity test according to EN 61000-4-5:1995 (AC/DC Line to Line: ±1 kV, AC/DC Line to Earth: ±2 kV)
- Immunity to conducted disturbances, Induced by radio-frequency fields: EN 61000-4-6:1996 (0.15 - 80 MHz with 1 kHz AM 80% Modulation: 3 V/m)
- Power frequency magnetic field immunity test according to EN 61000-4-8:1993 (1 A/m at frequency 50 Hz)
- Voltage dips, short interruptions and voltage variations immunity test according to EN 61000-4-11:1994 (>95% Reduction @10 ms, 30% Reduction @500 ms, >95% Reduction @5000 ms)

LVD:
- EN 60950 (A1/1992; A2/1993; A3/1993; A4/1995; A11/1997)

Warning! Do not plug a phone jack connector in the RJ-45 port. This may damage this device. Les raccordeurs ne sont pas utilisé pour le système téléphonique!

Taiwan BSMI Class A

警告使用者：這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Australia AS/NZS 3548 (1995) - Class A

ACN 066 352 010

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Safety Compliance

Warning: Fiber Optic Port Safety

When using a fiber optic port, never look at the transmit laser while it is powered on. Also, never look directly at the fiber TX port and fiber cable ends when they are powered on.

Avertissment: Ports pour fibres optiques - sécurité sur le plan optique

Ne regardez jamais le laser tant qu'il est sous tension. Ne regardez jamais directement le port TX (Transmission) à fibres optiques et les embouts de câbles à fibres optiques tant qu'ils sont sous tension.

Warnhinweis: Faseroptikanschlüsse - Optische Sicherheit

Niemals ein Übertragungslaser betrachten, während dieses eingeschaltet ist. Niemals direkt auf den Faser-TX-Anschluß und auf die Faserkabelenden schauen, während diese eingeschaltet sind.

Underwriters Laboratories Compliance Statement

Important! Before making connections, make sure you have the correct cord set. Check it (read the label on the cable) against the following:

Operating Voltage	Cord Set Specifications
120 Volts	UL Listed/CSA Certified Cord Set
	Minimum 18 AWG
	Type SVT or SJT three conductor cord
	Maximum length of 15 feet
	Parallel blade, grounding type attachment plug rated 15A, 125V
240 Volts (Europe only)	Cord Set with H05VV-F cord having three conductors with minimum diameter of 0.75 mm^2
	IEC-320 receptacle
	Male plug rated 10A, 250V

The unit automatically matches the connected input voltage. Therefore, no additional adjustments are necessary when connecting it to any input voltage within the range marked on the rear panel.

Wichtige Sicherheitshinweise (Germany)

1. Bitte lesen Sie diese Hinweise sorgfältig durch.
2. Heben Sie diese Anleitung für den späteren Gebrauch auf.
3. Vor jedem Reinigen ist das Gerät vom Stromnetz zu trennen. Verwenden Sie keine Flüssigoder Aerosolreiniger. Am besten eignet sich ein angefeuchtetes Tuch zur

Reinigung.

4. Die Netzanschlu ßsteckdose soll nahe dem Gerät angebracht und leicht zugänglich sein.
5. Das Gerät ist vor Feuchtigkeit zu schützen.
6. Bei der Aufstellung des Gerätes ist auf sicheren Stand zu achten. Ein Kippen oder Fallen könnte Beschädigungen hervorrufen.
7. Die Belüftungsöffnungen dienen der Luftzirkulation, die das Gerät vor Überhitzung schützt. Sorgen Sie dafür, daß diese Öffnungen nicht abgedeckt werden.
8. Beachten Sie beim Anschluß an das Stromnetz die Anschlußwerte.
9. Verlegen Sie die Netzanschlußleitung so, daß niemand darüber fallen kann. Es sollte auch nichts auf der Leitung abgestellt werden.
10. Alle Hinweise und Warnungen, die sich am Gerät befinden, sind zu beachten.
11. Wird das Gerät über einen längeren Zeitraum nicht benutzt, sollten Sie es vom Stromnetz trennen. Somit wird im Falle einer Überspannung eine Beschädigung vermieden.
12. Durch die Lüftungsöffnungen dürfen niemals Gegenstände oder Flüssigkeiten in das Gerät gelangen. Dies könnte einen Brand bzw. elektrischen Schlag auslösen.
13. Öffnen sie niemals das Gerät. Das Gerät darf aus Gründen der elektrischen Sicherheit nur von authorisiertem Servicepersonal geöffnet werden.
14. Wenn folgende Situationen auftreten ist das Gerät vom Stromnetz zu trennen und von einer qualifizierten Servicestelle zu überprüfen:
    a. Netzkabel oder Netzstecker sind beschädigt.
    b. Flüssigkeit ist in das Gerät eingedrungen.
    c. Das Gerät war Feuchtigkeit ausgesetzt.
    d. Wenn das Gerät nicht der Bedienungsanleitung entsprechend funktioniert oder Sie mit Hilfe dieser Anleitung keine Verbesserung erzielen.
    e. Das Gerät ist gefallen und/oder das Gehäuse ist beschädigt.
    f. Wenn das Gerät deutliche Anzeichen eines Defektes aufweist.
15. Zum Netzanschluß dieses Gerätes ist eine geprüfte Leitung zu verwenden. Für einen Nennstrom bis 6A und einem Gerätegewicht größer 3kg ist eine Leitung nicht leichter als H05VV-F, 3G, 0.75mm^2 einzusetzen.

Der arbeitsplatzbezogene Schalldruckpegel nach DIN 45 635 Teil 1000 beträgt 70dB(A) oder weniger.

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Glossary

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Chapter 1: About the Switch

Overview

This switch is an intelligent Fast Ethernet switch with 24 10BASE-T / 100BASE-TX (RJ-45) Ports and 2 Slots for 100BASE-FX or Gigabit Uplink Modules. This switch can easily tame your network with full support for Spanning Tree Protocol, Multicast Switching, Virtual LANs, and Layer 2/3/4 CoS services.

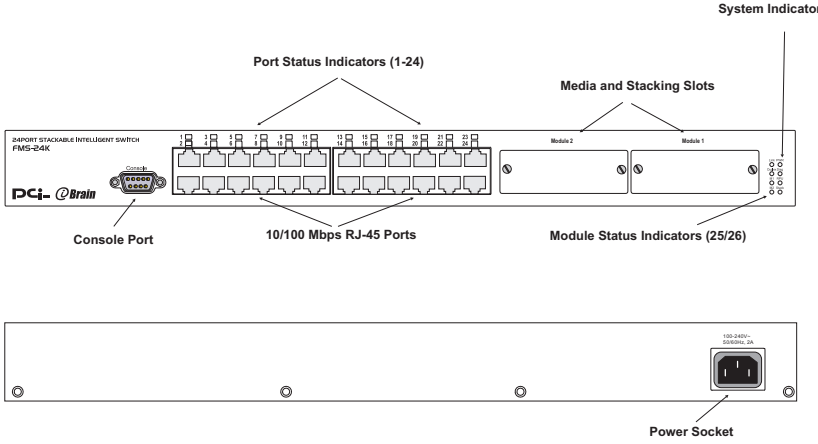


Figure 1-1. Front and Rear Panels

Switch Architecture

The FMS-24K employs a wire-speed, non-blocking switching fabric. This permits simultaneous wire-speed transport of multiple packets at low latency on all ports. This switch also features full-duplex capability on all ports, which effectively doubles the bandwidth of each connection.

Auto-negotiation is used to select the optimal transmission speed and communication mode for each connection. With store-and-forward switching and flow control, maximum data integrity is always maintained, even under heavy loading.

This switch includes two slots on the front panel for slide-in 1000BASE-LX, 1000BASE-SX, 1000BASE-T, 100BASE-FX, or 1000BASE-X (GBIC) modules. Cascade connections between switches can be made using these modules.

The switch also supports a stacking module that can be installed into slot Module 2. The stacking module allows up to eight units to be linked together and managed from one unit using one IP address.

Management Options

This switch contains a comprehensive array of LEDs for “at-a-glance” monitoring of network and port status. It also includes a management agent that allows you to configure or monitor the switch using its embedded management software, or via SNMP applications. To manage the switch, you can make a direct connection to the RS-232 console port (out-of-band), or you can manage the switch through a network connection (in-band) using Telnet, the on-board Web agent, or Windows-based network management software.

The management agent provides a wide range of advanced performance-enhancing features. Port-based VLANs provide traffic security and efficient use of network bandwidth. QoS priority queueing ensures the minimum delay for moving real-time multimedia data through the switch. Flow control eliminates the loss of packets due to bottlenecks caused by port saturation. Port security is provided to filter unwanted traffic from the switch.

For a detailed description of the switch’s advanced features, refer to the Management Guide.

Description of Hardware

RJ-45 Ports

The switch base unit contains 24 10BASE-T/100BASE-TX RJ-45 ports. All of these ports support automatic MDI/MDI-X operation, so you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs. (See “10BASE-T/100BASE-TX Pin Assignments” on page B-2.)

Each of these ports support auto-negotiation, so the optimum transmission mode (half or full duplex), and data rate (10 or 100 Mbps) can be selected automatically, if this feature is also supported by the attached device. If a device connected to one of these ports does not support auto-negotiation, the correct speed will be sensed by the port, but the transmission mode will default to half duplex.

Each port also supports auto-negotiation of flow control, so the switch can automatically prevent port buffers from becoming saturated.

Port Status LEDs

The base unit also includes a display panel for key system and port indications that simplify installation and network troubleshooting. The LEDs, which are located on the front panel for easy viewing, are shown below and described in the following tables.

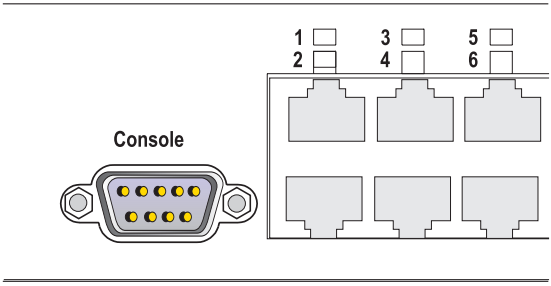


Figure 1-2. Port Status LEDs

Port Status LEDs		
LED	**Condition**	**Status**
Base Unit Ports		
1~24 (Link/Activity)	On/Flashing Amber	Port has established a valid 10 Mbps network connection. Flashing indicates activity.
	On/Flashing Green	Port has established a valid 100 Mbps network connection. Flashing indicates activity.
	Off	There is no valid link on the port.
Module Ports		
25, 26 (Link/Activity)	On/Flashing Amber	Port has established a valid 10/100 Mbps network connection. Flashing indicates activity.
	On/Flashing Green	Port has established a valid 1000 Mbps network connection. Flashing indicates activity.
	Off	There is no valid link on the port.

System Status LEDs

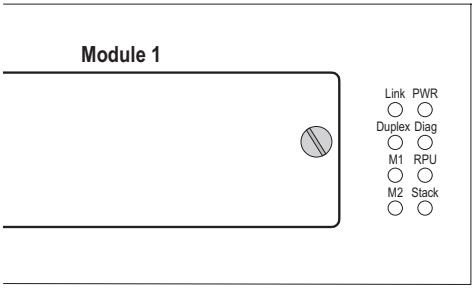


Figure 1-3. System Status LEDs

System Status LEDs		
LED	**Condition**	**Status**
PWR	On Green	The unit's internal power supply is operating normally.
	On Amber	The unit's internal power supply has failed.
	Off	The unit has no power connected.
Diag	On Green	The system diagnostic test has completed successfully.
	Flashing Green	The system diagnostic test is in progress.
	On Amber	The system diagnostic test has detected a fault.
Link	N/A	This indicator is not currently implemented.
Duplex	N/A	This indicator is not currently implemented.
Stack	Flashing Amber	An initial state of stacking configuration upon powering on.
	Green	This switch is acting as the master unit in the stack.
	Amber	This switch is acting as a slave unit in the stack.
	Flashing Green	When the user enters the **light unit** command in the CLI, the unit ID of each switch in the stack will be displayed by port LEDs 1 to 8.

Optional Media Extender Modules

Optional 1000BASE-T Module

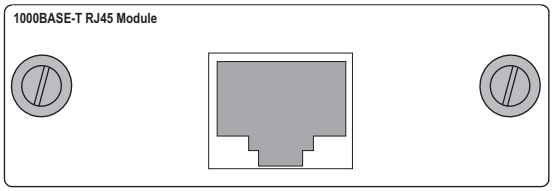


Figure 1-4. Single-Port 1000BASE-T Module

Using Category 5, 5e, or 6 twisted-pair cable you can connect to another device up to 100 m (328 ft) away. The 1000BASE-T module operates at 10/100/1000 Mbps. At 1000 Mbps it operates at full duplex and supports auto-negotiation of speed and flow control. At 10/100 Mbps it supports auto-negotiation of speed, duplex mode (i.e., half or full duplex), and flow control. Note that you should first test the cable installation for IEEE 802.3ab compliance. See “1000BASE-T Cable Requirements” on page B-5.

Optional 1000BASE-SX Module

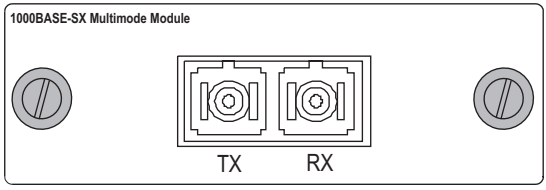


Figure 1-5. Single-Port 1000BASE-SX Gigabit Module

Using multimode fiber optic cable, the 1000BASE-SX port can be connected to a remote site up to 550 m (1805 ft) away. The 1000BASE-SX Gigabit module operates at 1 Gbps, with support for full-duplex mode and flow control.

Optional 1000BASE-LX Module

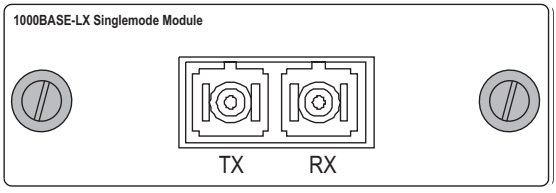


Figure 1-6. Single-Port 1000BASE-LX Gigabit Module

Using single-mode fiber optic cable, the 1000BASE-LX port can be connected to a remote site up to 5 km (16404 ft) away. The 1000BASE-LX Gigabit module operates at 1 Gbps, with support for full-duplex mode and flow control.

Optional 100BASE-FX Multimode Module

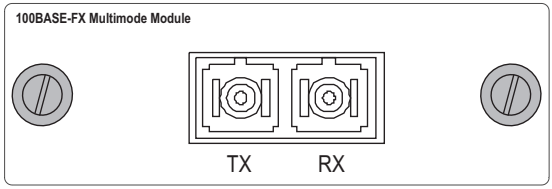


Figure 1-7. Single-Port 100BASE-FX Multimode Module

Using multimode fiber optic cable, the 100BASE-FX port can be connected to a remote site up to 2 km (1.24 miles) away. The 100BASE-FX module is fixed to operate at 100 Mbps full duplex, and supports auto-negotiation for flow control. The module is fitted with an SC connector.

Optional 100BASE-FX Single-mode Module

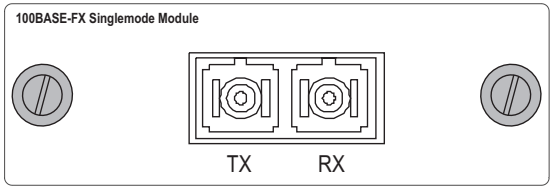


Figure 1-8. Single-Port 100BASE-FX Single-mode Module

Using fiber optic cable, the 100BASE-FX port can be connected to a remote site up to 20 km (12.43 miles) away. The 100BASE-FX module is fixed to operate at 100 Mbps full duplex, and supports auto-negotiation for flow control. The module is fitted with an SC connector.

Optional 1000BASE-X GBIC Module

Figure 1-9. Single Port 1000BASE-X GBIC Module

This module supports 5 V 1000BASE-SX, 1000BASE-LX and 1000BASE-LH GBIC transceivers:

1000BASE-SX GBIC transceivers provide one short-wavelength (850 nm) Gigabit port that can be used for a high-speed backbone or server connection. This port can be connected to a site up to 220 m (722 ft) away with 62.5/125 micron multimode fiber cable, or up to 500 m (1641 ft) with 50/125 micron multimode fiber cable.

1000BASE-LX GBIC transceivers provide one long-wavelength (1300 nm) Gigabit port that can be used for a high-speed backbone or server connection. This port can be connected to a site up to 5 km (16404 ft) away with single-mode fiber cable.

1000BASE-LH GBIC transceivers provide one long-wavelength (1550 nm) Gigabit port that can be used for a long-haul connection to a remote location. This port can be connected to a site up to 70 km (43.5 miles) away with single-mode fiber cable.

Caution: Install only 5 V GBIC transceivers into the module slots.

Optional Stacking Module

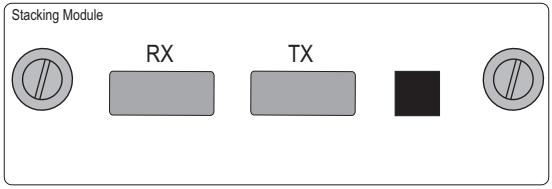


Figure 1-10. Stacking Module

The module provides two 1 Gbps ports via USB Type-A connectors. The right port is a transmit port and the one on the left a receive port. The module allows up to eight switches to be linked together using stacking cables (ordered separately). The push button on the module enables one switch in the stack to be selected as the master.

Combo Module

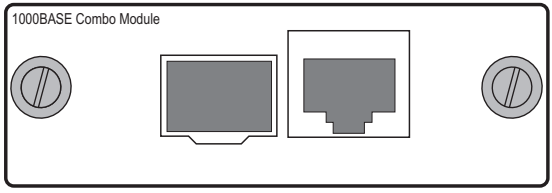


Figure 1-11. Combo Module

This combo module provides a Gigabit RJ-45 port with a shared Small Form Factor Pluggable (SFP) transceiver slot. If an SFP transceiver (purchased separately) is installed in a slot and has a valid link on the port, the associated RJ-45 port is

disabled.

To connect a device to an SFP port, do the following:

1. Use your cabling requirements to select an appropriate SFP transceiver type.
2. Insert the SFP transceiver (sold separately) into an SFP slot. The slot's LED indicator turns on to confirm that it is correctly installed.

The 1000BASE-T RJ-45 ports support automatic MDI/MDI-X operation, so you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs. (See "10BASE-T/100BASE-TX Pin Assignments" on page B-2.)

Power Supply Receptacle

The power receptacle is located on the rear panel of the switch. The standard power receptacle is for the AC power cord.

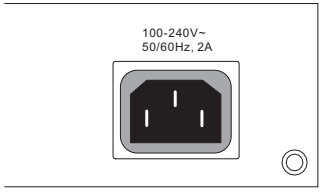


Figure 1-12. Power Supply Receptacle

Features and Benefits

Connectivity

- 24 dual-speed ports for 10 or 100 Mbps Ethernet connections
- Auto-negotiation enables each RJ-45 port to automatically select the optimum communication mode (half or full duplex) for the attached device
- Independent RJ-45 ports with support for automatic MDI/MDI-X
- Unshielded (UTP) cable supported on all RJ-45 ports: Category 3, 4 or 5 for 10 Mbps connections and Category 5 for 100 Mbps connections
- IEEE 802.3 Ethernet and 802.3u Fast Ethernet compliance ensures compatibility with standards-based hubs, network cards and switches from any vendor
- Provides stacking capability via a module with 1 Gbps stacking bandwidth. Up to 8 units can be stacked.

Expandability

- Optional single-port 1000BASE-SX Gigabit module that can run up to 550 meters using 50/125 micron multimode fiber cable, and operates at 1 Gbps, full duplex, with auto-negotiation for flow control
- Optional single-port 1000BASE-LX Gigabit module that can run up to 5 km using 9/125 micron single-mode fiber cable, and operates at 1 Gbps, full duplex, with auto-negotiation for flow control
- Optional single-port 1000BASE-T Gigabit module that can run up to 100 meters using 100-ohm Category 5, 5e, or 6 unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable, and operates at 1 Gbps, full duplex, with auto negotiation for flow control
- Optional single-port 100BASE-FX module that can run up to 20 km using 9/125 micron single-mode fiber cable and operates at 100 Mbps, full duplex, with auto-negotiation for flow control
- Optional single-port 100BASE-TX module that can run a connection up to 100 meters away using 100-ohm Category 5 unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable, and operates at 10/100 Mbps, full/half duplex, with auto negotiation for speed, duplex mode, and flow control
- Optional 2-port 1000BASE-T module, with combined Small Form Factor Pluggable (SFP) slot
- Optional 1000BASE-X GBIC module

Performance

- Transparent bridging
- Aggregate bandwidth up to 8.8 Gbps
- Switching Table with 8K MAC address entries
- Filtering and forwarding at line speed

- Desktop or rack-mountable

Management

- “At-a-glance” LEDs for easy troubleshooting
- Management agent:
  - Supports Telnet, SNMP and Web-based interface
  - Manages switch (or entire stack) in-band or out-of-band
  - Spanning Tree Protocol
  - Private VLAN function providing port-based security and isolation between ports
  - VLAN support with up to 256 groups, port-based or with 802.1Q VLAN tagging, and GVRP for automatic VLAN learning
  - Quality of Service (QoS) supports four levels of priority and Weighted Round Robin
  - Multicast Switching based on IGMP Snooping
  - Port trunking supported for 2, 3 or 4-port groups

Chapter 2: Network Planning

Introduction to Switching

A network switch allows simultaneous transmission of multiple packets via non-crossbar switching. This means that it can partition a network more efficiently than bridges or routers. The switch has, therefore, been recognized as one of the most important building blocks for today's networking technology.

When performance bottlenecks are caused by congestion at the network access point (such as the network card for a high-volume file server), the device experiencing congestion (server, power user or hub) can be attached directly to a switched port. And, by using full-duplex mode, the bandwidth of the dedicated segment can be doubled to maximize throughput.

When networks are based on repeater (hub) technology, the maximum distance between end stations is limited. For Ethernet, there may be up to four hubs between any pair of stations; for Fast Ethernet, the maximum is two. This is known as the hop count. However, a switch turns the hop count back to zero. So subdividing the network into smaller and more manageable segments, and linking them to the larger network by means of a switch, removes this limitation.

A switch can be easily configured in any Ethernet or Fast Ethernet network to significantly boost bandwidth while using conventional cabling and network cards.

Application Examples

This switch is not only designed to segment your network, but also to provide a wide range of options in setting up network connections. Some typical applications are described below.

Collapsed Backbone

This switch is an excellent choice for mixed Ethernet and Fast Ethernet installations where significant growth is expected in the near future. You can easily build on this basic configuration, adding direct full-duplex connections to workstations or servers. When the time comes for further expansion, just cascade the switch to an Ethernet or Fast Ethernet hub or switch.

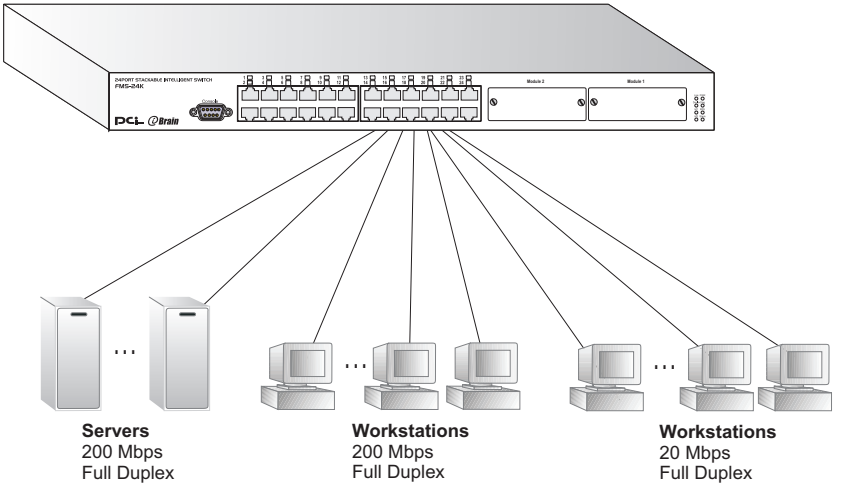


Figure 2-1. Collapsed Backbone

Central Wiring Closet

With 26 parallel bridging ports (i.e., 26 distinct collision domains), this switch can collapse a complex network down into a single efficient bridged node, increasing overall bandwidth and throughput.

In the figure below, the 10BASE-T/100BASE-TX ports on the switch are providing 100 Mbps connectivity for up to 24 segments. In addition, the switch is also connecting servers at 100 Mbps.

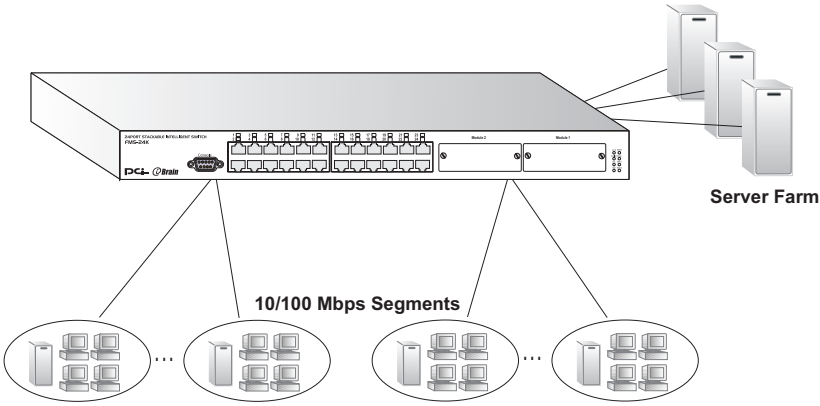


Figure 2-2. Central Wiring Closet

Making VLAN Connections

VLANs can be based on port groups, or each data frame can be explicitly tagged to identify the VLAN group to which it belongs. When using port-based VLANs, ports can either be assigned to one specific group or to all groups. Port-based VLANs are suitable for small networks. A single switch can be easily configured to support several VLAN groups for various organizational entities (such as Finance and Marketing).

When you expand port-based VLANs across several switches, you need to make a separate connection for each VLAN group. This approach is, however, inconsistent with the Spanning Tree Protocol, which can easily segregate ports that belong to the same VLAN. When VLANs cross separate switches, it is therefore better to use VLAN tagging. This allows you to assign multiple VLAN groups to the “trunk” ports (that is, tagged ports) connecting different switches.

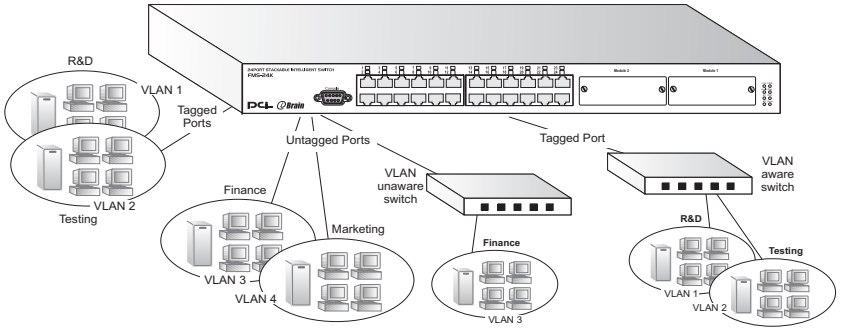


Figure 2-3. Making VLAN Connections

Connectivity Rules

When adding hubs (repeaters) to your network, please follow the connectivity rules listed below for Ethernet, Fast Ethernet, or Gigabit Ethernet. However, note that because switches break up the path for connected devices into separate collision domains, you should not include the switch or connected cabling in your calculations for cascade length involving other devices.

Maximum Fiber Optic Cable Distance for 1000BASE-SX		
Fiber Size	**Fiber Bandwidth**	**Maximum Cable Length**
62.5/125 micron	160 MHz/km	2-220 m (7-722 ft)
	200 MHz/km	2-275 m (7-902 ft)
50/125 micron	400 MHz/km	2-500 m (7-1641 ft)
	500 MHz/km	2-550 m (7-1805 ft)

Maximum Fiber Optic Cable Distance for 1000BASE-LX		
Fiber Size	**Fiber Bandwidth**	**Maximum Cable Length**
9/125 micron	N/A	2 m - 5 km (7 - 16404 ft)

Maximum Cable Distance for 1000BASE-T		
Type	**Connector**	**Maximum Cable Length**
Cat. 5, 5e, or 6 100-ohm UTP	RJ-45	100 m (328 ft)

Maximum Cable Distance for 10/100BASE		
Type	**Cable Type**	**Maximum Cable Length**
10BASE-T	Twisted Pair, Categories 3, 4, 5	100 m (328 ft)
100BASE-TX	Category 5 100-ohm UTP or STP	100 m (328 ft)
100BASE-FX Multimode	50/125 or 62.5/125 micron core multimode fiber (MMF)	2 km (1.24 miles)
100BASE-FX Single-Mode	9/125 micron core single-mode fiber (SMF)	20 km (12.43 miles)

Application Notes

1. Full-duplex operation only applies to point-to-point access (such as when a switch is attached to a workstation, server or another switch). When the switch is connected to a hub, both devices must operate in half-duplex mode.

2. When a switch is connected to a hub or any kind of shared media, you may want to turn off back pressure flow control to prevent jamming packets from being propagated thoughout the hub.

3. As a general rule the length of fiber optic cable for a single switched link should not exceed:

   - 1000BASE-SX/LX: 550 m (1805 ft) for multimode fiber or 5 km (16404 ft) for single-mode fiber.
   - 100BASE-FX: 2 km (1.24 miles) for multimode fiber or 20 km (2.43 miles) for single-mode fiber.

   However, power budget constraints must also be considered when calculating the maximum cable length for your specific environment.

Chapter 3: Installing the Switch

Selecting a Site

Switch units can be mounted in a standard 19-inch equipment rack or on a flat surface. Be sure to follow the guidelines below when choosing a location.

- The site should:
  - be at the center of all the devices you want to link and near a power outlet
  - be able to maintain its temperature within 0 to 50° C (32 to 122 °F) and its humidity within 10% to 90%, non-condensing
  - provide adequate space (approximately two inches) on all sides for proper air flow
  - be accessible for installing, cabling and maintaining the devices
  - allow the status LEDs to be clearly visible
- Make sure twisted-pair cable is always routed away from power lines, fluorescent lighting fixtures and other sources of electrical interference, such as radios, transmitters, etc.
- Make sure that a separate grounded power outlet that provides 100 to 240 VAC, 50 to 60 Hz, is within 2.44 m (8 feet) of each device and is powered from an independent circuit breaker. As with any equipment, using a filter or surge suppressor is recommended.

Equipment Checklist

After unpacking the switch, check the contents to be sure you have received all the components. Then, before beginning the installation, be sure you have all other necessary installation equipment.

Package Contents

- 24-Port Fast Ethernet Switch
- Four adhesive foot pads
- Bracket Mounting Kit containing two brackets and four screws for attaching the brackets to the switch
- Power Cord—either US, Continental Europe or UK
- RS-232 console cable
- This Installation Guide
- Management Guide

Optional Rack-Mounting Equipment

If you plan to rack-mount the switch, be sure to have the following equipment available:

- Four mounting screws for each device you plan to install in a rack—these are not included
- A screwdriver (Phillips or flathead, depending on the type of screws used)

Mounting

A switch unit can be mounted in a standard 19-inch equipment rack or on a desktop or shelf. Mounting instructions for each type of site follow.

Installing Optional Modules: Before mounting the switch, be sure you install any optional modules. If you have purchased optional slide-in 1000BASE-T, 1000BASE-SX, 1000BASE-LX, 100BASE-FX, or 1000BASE-X GBIC media expansion modules, install these modules now, following the instructions “Installing an Optional Module into the Switch” on page 3-4.

Rack Mounting

Before rack mounting the switch, pay particular attention to the following factors:

- **Temperature:** Since the temperature within a rack assembly may be higher than the ambient room temperature, check that the rack-environment temperature is within the specified operating temperature range. (See page C-1.)
- **Mechanical Loading:** Do not place any equipment on top of a rack-mounted unit
- **Circuit Overloading:** Be sure that the supply circuit to the rack assembly is not overloaded.
- **Grounding:** Rack-mounted equipment should be properly grounded. Particular attention should be given to supply connections other than direct connections to the mains.

To rack-mount devices:

1. Attach the brackets to the device using the screws provided in the Bracket Mounting Kit.

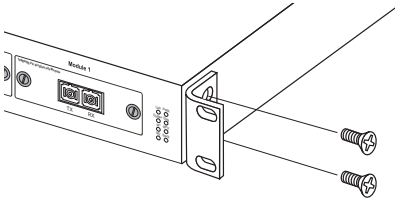


Figure 3-1. Attaching the Brackets

2. Mount the device in the rack, using four rack-mounting screws (not provided).

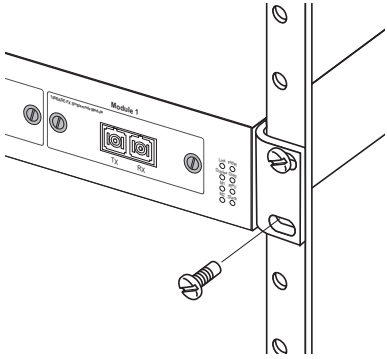


Figure 3-2. Installing the Switch in a Rack

3. If installing a single switch only, turn to “Connecting to a Power Source” at the end of this chapter.

4. If installing multiple switches, mount them in the rack, one below the other, in any order.

Desktop or Shelf Mounting

1. Attach the four adhesive feet to the bottom of the first switch.

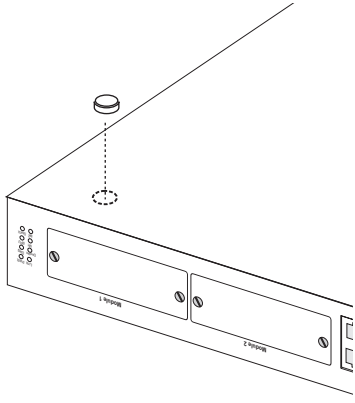


Figure 3-3. Attaching the Adhesive Feet

2. Set the device on a flat surface near an AC power source, making sure there are at least two inches of space on all sides for proper air flow.

3. If installing a single switch only, go to “Connecting to a Power Source” at the end of this chapter.

4. If installing multiple switches, attach four adhesive feet to each one. Place each device squarely on top of the one below, in any order.

Installing an Optional Module into the Switch

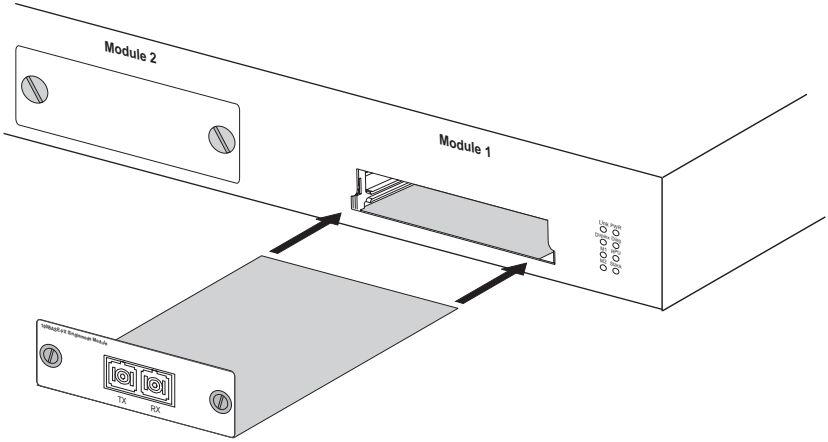


Figure 3-4. Installing an Optional Module

Caution: DO NOT install slide-in modules with the switch powered on. Be sure you power off the switch before installing any module.

Note: The stacking module must only be installed in slot Module 2.

To install an optional module into the switch, do the following:

1. Disconnect power to the switch.

2. Remove the blank metal plate (or a previously installed module) from the appropriate slot by removing the two screws with a flat-head screwdriver.

3. With the module still in the anti-static bag, touch the metal frame of the switch to prevent damage caused by static electricity discharge. Also, it is recommended to use an ESD wrist strap during installation.

4. Remove the module from the anti-static shielded bag.

5. Holding the module level, guide it into the carrier rails on each side and gently push it all the way into the slot, ensuring that it firmly engages with the connector.

Installing a GBIC Transceiver

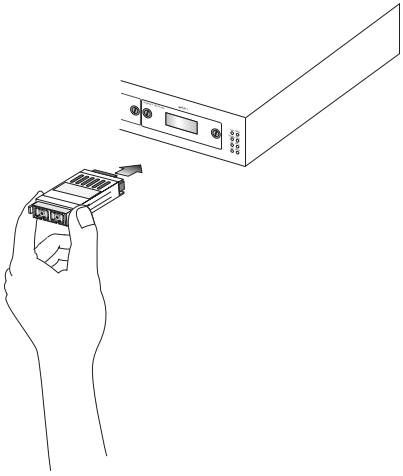


Figure 3-5. Installing a GBIC Transceiver

You can install a GBIC transceiver as described below:

1. Insert the transceiver with the SC connector facing out toward you. Note that the transceiver is keyed so that it can only be installed in one orientation.
2. Press in on the transceiver's side tabs, and gently slide it into the GBIC interface slot until it clicks into place.

Note: GBIC transceivers are hot-swappable. You do not need to power off the switch before installing or removing a transceiver.

Caution: Install only 5 V GBIC transceivers into the module slots.

Connecting to the Stack's Backplane

Plug one end of the stack cable (ordered separately) in the TX (right) port of the top unit and the other end to the RX (left) port of the next unit. Repeat this step for each unit in the stack. Form a simple chain starting at the TX port on the top unit and ending at the RX port on the bottom unit (stacking up to 8 units). Finally, complete the stack connections by plugging one end of a stack cable into the TX port on the bottom unit and the other end into the RX port on the top unit.

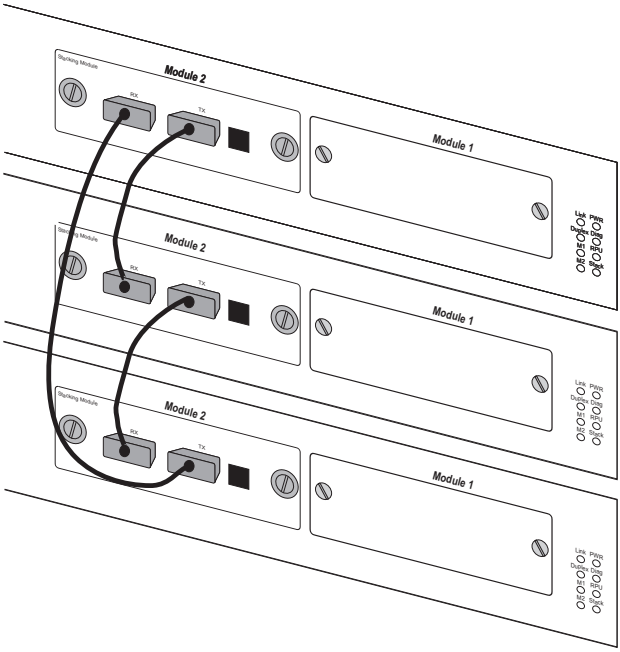


Figure 3-6. Connecting to backplane

Select the Master unit in the stack by pressing the push button in on only one of the stacking modules. Only one switch in the stack can operate as the Master, all other units operate in slave mode. If more than one switch in the stack is selected as Master, or if no switches are selected, the stack will not function.

Note: The stacking feature requires that all stacking module ports be connected and the switches powered on. If one stack link is not connected, or if a switch is powered off, the stack will not function.

Connecting to a Power Source

To connect a device to a power source:

1. Insert the power cable plug directly into the receptacle located at the back of the device.

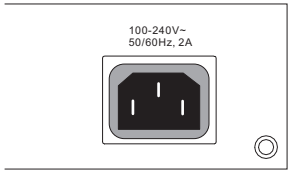


Figure 3-7. Power Receptacle

2. Plug the other end of the cable into a grounded, 3-pin socket.

   Note: For International use, you may need to change the AC line cord. You must use a line cord set that has been approved for the receptacle type in your country.

3. Check the front-panel LEDs as the device is powered on to be sure the Power LED is lit. If not, check that the power cable is correctly plugged in.

Chapter 4: Making Network Connections

Connecting Network Devices

The switch may be connected to 10 or 100 Mbps network cards in PCs and servers, as well as to Ethernet and Fast Ethernet hubs and switches. It may also be connected to remote devices using the optional fiber optic modules.

Twisted-Pair Devices

Each device requires a shielded or unshielded twisted-pair (STP or UTP) cable with RJ-45 connectors at both ends. For 1000BASE-T Category 5, 5e, or 6 cable is required, for 100BASE-TX connections, Category 5 cable is required; for 10BASE-T, Category 3, 4 or 5 cable can be used.

Cabling Guidelines

A twisted-pair connection between two ports must have a crossover of the transmit and receive wires to be able to function. This crossover can be implemented in either of the ports, or in the cable connecting them.

Network card ports in PCs and servers do not contain an internal wiring crossover, these are known as straight-through (MDI) ports. Therefore, most switch and hub ports implement a built-in crossover — known as fixed crossover (MDI-X) ports — so that they can be connected to PCs and servers using standard straight-through cable. Some switches and hubs also have an MDI port, so that they can connect to another switch's/hub's MDI-X port using straight-through cable. To connect between two switches/hubs that only have fixed MDI-X ports, the wiring crossover must be implemented in the cable — known as a crossover cable.

The RJ-45 ports on the switch base unit support automatic MDI/MDI-X operation, which means that they automatically detect the wiring in the link and configure as MDI or MDI-X accordingly. So for these ports, you can use standard straight-through twisted-pair cables to connect to any other network device (PCs, servers, switches, hubs, or routers). However, note that auto-negotiation must be enabled on these ports for automatic wiring configuration to function properly.

Connecting to PCs, Servers, Hubs and Switches

Caution: Do not plug a phone jack connector into an RJ-45 port. This will damage the switch. Use only twisted-pair cables with RJ-45 connectors that conform to FCC standards.

1. Attach one end of a twisted-pair cable segment to the device's RJ-45 connector.

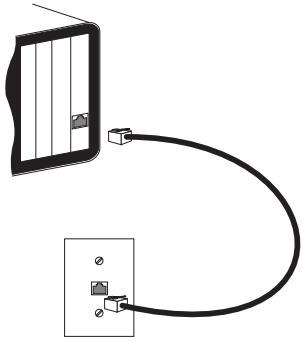


Figure 4-1. Making Twisted-Pair Connections

2. If the device is a PC card and the switch is in the wiring closet, attach the other end of the cable segment to a modular wall outlet that is connected to the wiring closet. (See "Wiring Closet Connections" on the next page.) Otherwise, attach the other end to an available port on the switch.

3. Make sure each twisted pair cable does not exceed 100 meters (328 ft) in length.

   Note: When connected to a shared collision domain (such as a hub with multiple workstations), switch ports must be set to half-duplex mode.

4. As each connection is made, the green Link LED (on the switch) corresponding to each port will light to indicate that the connection is valid.

Wiring Closet Connections

Today, the punch-down block is an integral part of many of the newer equipment racks. It is actually part of the patch panel. Instructions for making connections in the wiring closet with this type of equipment follows.

1. Attach one end of a patch cable to an available port on the switch, and the other end to the patch panel.

2. If not already in place, attach one end of a cable segment to the back of the patch panel where the punch-down block is located, and the other end to a

modular wall outlet.

3. Label the cables to simplify future troubleshooting.

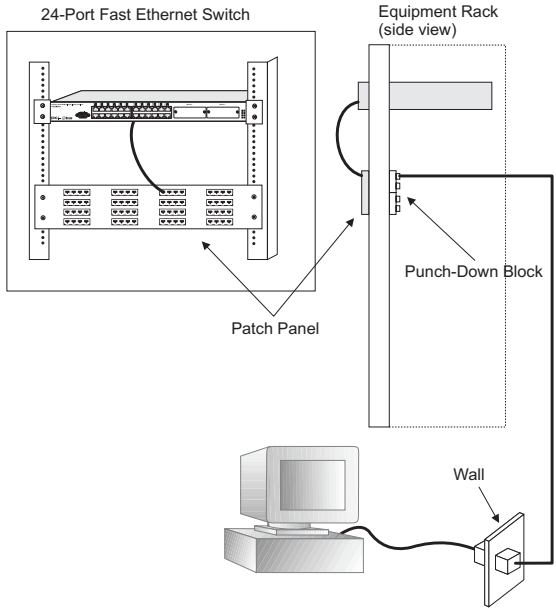


Figure 4-2. Wiring Closet Connections

Fiber Optic Devices

An optional slide-in 1000BASE-SX, 1000BASE-LX or 100BASE-FX module, or 1000BASE-X transceiver may be used for backbone and long distance connections. A 1000BASE-SX, 100BASE-LX, or 1000BASE-X transceiver may also be for connecting to a high-speed server.

Each single-mode fiber optic port requires 9/125 micron multimode fiber optic cabling with an SC connector at both ends. Each multimode fiber optic port requires 50/125 or 62.5/125 micron multimode fiber optic cabling with an SC connector at both ends.

Warning: This switch uses lasers to transmit signals over fiber optic cable. The lasers are compliant with the requirements of a Class 1 Laser Product and are inherently eye safe in normal operation. However, you should never look directly at a transmit port when it is powered on.

1. Remove and keep the SC port's rubber plug. When not connected to a fiber cable, the rubber plug should be replaced to protect the optics.
2. Check that the fiber terminators are clean. You can clean the cable plugs by wiping them gently with a clean tissue or cotton ball moistened with a little ethanol. Dirty fiber terminators on fiber optic cables will impair the quality of the light transmitted through the cable and lead to degraded performance on the port.
3. Connect one end of the cable to the SC port on the switch and the other end to the SC port on the other device. Since SC connectors are keyed, the cable can be attached in only one orientation.

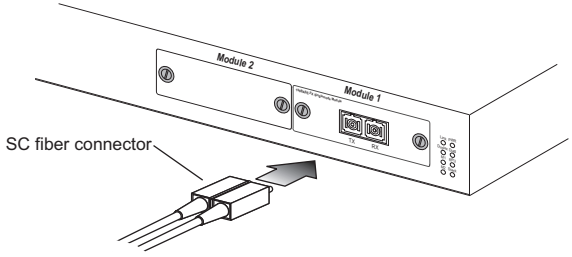


Figure 4-3. Making SC Port Connections

4. As a connection is made, check the Activity LED on the switch's front panel for the corresponding module to be sure that the connection is valid.

Appendix A: Troubleshooting

Diagnosing Switch Indicators

Troubleshooting Chart	
Symptom	**Action**
PWR LED is Off	• Internal power supply is disconnected. • Check connections between the switch, the power cord, the wall outlet.
PWR LED is Amber	• Internal power supply has failed. • Contact your local dealer for assistance.
Link LED is Off	• Verify that the switch and attached device are powered on. • Be sure the cable is plugged into both the switch and corresponding device. • If the switch is installed in a rack, check the connections to the punch-down block and patch panel. • Verify that the proper cable type is used and its length does not exceed specified limits. • Check the adapter on the attached device and cable connections for possible defects. Replace the defective adapter or cable if necessary.

Power and Cooling Problems

If the power indicator does not turn on when the power cord is plugged in, you may have a problem with the power outlet, power cord, or internal power supply. However, if the unit powers off after running for a while, check for loose power connections, power losses or surges at the power outlet, and verify that the fans on the unit are unobstructed and running prior to shutdown. If you still cannot isolate the problem, then the internal power supply may be defective.

Installation

Verify that all system components have been properly installed. If one or more components appear to be malfunctioning (such as the power cord or network cabling), test them in an alternate environment where you are sure that all the other components are functioning properly.

In-Band Access

You can access the management agent in the switch from anywhere within the attached network using Telnet, a Web browser, or other network management software. However, you must first configure the switch with a valid IP address, subnet mask, and default gateway. If you have trouble establishing a link to the management agent, check to see if you have a valid network connection. Then

verify that you entered the correct IP address. Also, be sure the port through which you are connecting to the switch has not been disabled.
If it has not been disabled, then check the network cabling that runs between your remote location and the switch.

Note: The management agent accepts up to four simultaneous Telnet sessions. If the maximum number of sessions already exists, an additional Telnet connection will not be able to log into the system.

Appendix B: Cables

Specifications

Cable Types and Specifications			
Cable	**Type**	**Max. Length**	**Connector**
10BASE-T	Cat. 3, 4, 5 100-ohm UTP	100 m (328 ft)	RJ-45
100BASE-TX	Cat. 5 100-ohm UTP	100 m (328 ft)	RJ-45
100BASE-FX	50/125 or 62.5/125 micron core multimode fiber (MMF)	2 km (1.24 miles)	SC
100BASE-FX	9/125 9 micron core single-mode fiber (SMF)	20 km (12.43 miles)	SC
1000BASE-SX	50/125 or 62.5/125 micron core MMF	See the following table	SC
1000BASE-LX	9/125 micron SMF	5 km (3.12 miles)	SC
1000BASE-T	Cat. 5, 5e, or 6 100-ohm UTP	100 m (328 ft)	RJ-45

1000BASE-SX Fiber Specifications		
Fiber Diameter	**Fiber Bandwidth**	**Maximum Cable Length**
62.5/125 micron MMF	160 MHz/km	2-220 m (7-722 ft)
	200 MHz/km	2-275 m (7-902 ft)
50/125 micron MMF	400 MHz/km	2-500 m (7-1641 ft)
	500 MHz/km	2-550 m (7-1805 ft)

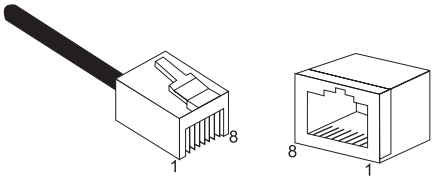
Twisted-Pair Cable and Pin Assignments

Caution: DO NOT plug a phone jack connector into any RJ-45 port. Use only twisted-pair cables with RJ-45 connectors that conform with FCC standards.

For 10BASE-T/100BASE-TX connections, a twisted-pair cable must have two pairs of wires. Each wire pair is identified by two different colors. For example, one wire might be red and the other, red with white stripes. Also, an RJ-45 connector must be attached to both ends of the cable.

Caution: Each wire pair must be attached to the RJ-45 connectors in a specific orientation. (See “Cabling Guidelines” on page 4-1 for an explanation.)

The figure below illustrates how the pins on the RJ-45 connector are numbered. Be sure to hold the connectors in the same orientation when attaching the wires to the pins.



10BASE-T/100BASE-TX Pin Assignments

Use unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable for RJ-45 connections: 100-ohm Category 3, 4 or 5 cable for 10 Mbps connections or 100-ohm Category 5 cable for 100 Mbps connections. Also be sure that the length of any twisted-pair connection does not exceed 100 meters (328 feet).

The RJ-45 ports on the switch base unit support automatic MDI/MDI-X operation, you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs. In straight-through cable, pins 1, 2, 3, and 6, at one end of the cable, are connected straight through to pins 1, 2, 3, and 6 at the other end of the cable. When using any RJ-45 port on this switch, you can use either straight-through or crossover cable.

Pin	MDI-X Signal Name	MDI Signal Name
1	Receive Data plus (RD+)	Transmit Data plus (TD+)
2	Receive Data minus (RD-)	Transmit Data minus (TD-)
3	Transmit Data plus (TD+)	Receive Data plus (RD+)
6	Transmit Data minus (TD-)	Receive Data minus (RD-)
4,5,7,8	Not used	Not used

Note: The “+” and “-” signs represent the polarity of the wires that make up each wire pair.

Straight-Through Wiring

If the twisted-pair cable is to join two ports and only one of the ports has an internal crossover (MDI-X), the two pairs of wires must be straight-through. (When auto-negotiation is enabled for any RJ-45 port on this switch, you can use either straight-through or crossover cable to connect to any device type.)

Straight-Through RJ-45 Pin Assignments	
End 1	End 2
1 (RD+)	1 (TD+)
2 (RD-)	2 (TD-)
3 (TD+)	3 (RD+)
6 (TD-)	6 (RD-)

Crossover Wiring

If the twisted-pair cable is to join two ports and either both ports are labeled with an “X” (MDI-X) or neither port is labeled with an “X” (MDI), a crossover must be implemented in the wiring. (When auto-negotiation is enabled for any RJ-45 port on this switch, you can use either straight-through or crossover cable to connect to any device type.)

Crossover RJ-45 Pin Assignments	
End 1	End 2
1 (TD+)	3 (RD+)
2 (TD-)	6 (RD-)
3 (RD+)	1 (TD+)
6 (RD-)	2 (TD-)

1000BASE-T Pin Assignments

The table below shows the 1000BASE-T MDI and MDI-X port pinouts. These ports require that all four pairs of wires be connected. Note that for 1000BASE-T operation, all four pairs of wires are used for both transmit and receive.

Use 100-ohm Category 5, 5e, or 6 unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable for 1000BASE-T connections. Also be sure that the length of any twisted-pair connection does not exceed 100 meters (328 feet).

Pin	MDI Signal Name	MDI-X Signal Name
1	Transmit Data plus (TD1+)	Transmit Data plus (TD2 +)
2	Receive Data minus (RD1-)	Receive Data minus (RD2-)
3	Transmit Data plus (TD2+)	Transmit Data plus (TD1+)
4	Transmit Data plus (TD3+)	Transmit Data plus (TD4+)

Pin	MDI Signal Name	MDI-X Signal Name
5	Receive Data minus (RD3-)	Receive Data minus (RD4-)
6	Receive Data minus (RD2-)	Receive Data minus (RD1-)
7	Transmit Data plus (TD4+)	Receive Data minus (RD3+)
8	Receive Data minus (RD4-)	Receive Data minus (RD3-)

1000BASE-T Cable Requirements

All Category 5 UTP cables that are used for 100BASE-TX connections should also work for 1000BASE-T, providing that all four wire pairs are connected. However, it is recommended that for all critical connections, or any new cable installations, Category 5e (enhanced Category 5) or 6 cable should be used. The Category 5e and 6 specification includes test parameters that are only recommendations for Category 5. Therefore, the first step in preparing existing Category 5 cabling for running 1000BASE-T is a simple test of the cable installation to be sure that it complies with the IEEE 802.3ab standards.

Cable Testing for Existing Category 5 Cable

Installed Category 5 cabling must pass tests for Attenuation, Near-End Crosstalk (NEXT), and Far-End Crosstalk (FEXT). This cable testing information is specified in the ANSI/TIA/EIA-TSB-67 standard. Additionally, cables must also pass test parameters for Return Loss and Equal-Level Far-End Crosstalk (ELFEXT). These tests are specified in the ANSI/TIA/EIA-TSB-95 Bulletin, “The Additional Transmission Performance Guidelines for 100 Ohm 4-Pair Category 5 Cabling.”

Note that when testing your cable installation, be sure to include all patch cables between switches and end devices.

Adjusting Existing Category 5 Cabling

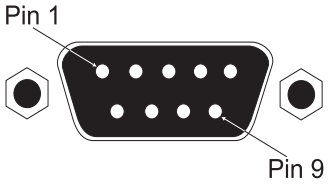
If your existing Category 5 installation does not meet one of the test parameters for 1000BASE-T, there are basically three measures that can be applied to try to correct the problem:

1. Replace any Category 5 patch cables with high-performance Category 5e or 6 cables.
2. Reduce the number of connectors used in the link.
3. Reconnect some of the connectors in the link.

Console Port Pin Assignments

The DB-9 serial port on the switch’s front panel is used to connect to the switch for out-of-band console configuration. The on-board menu-driven configuration program can be accessed from a terminal or a PC running a terminal emulation program. The pin assignments used to connect to the serial port are provided in the following

tables.



DB-9 Port Pin Assignments

EIA Circuit	CCITT Signal	Description	Switch's DB9 DTE Pin #	PC DB9 DTE Pin #	PC DB25 DTE Pin #
BB	104	**RxD** (Received Data)	2	2	3
BA	103	**TxD** (Transmitted Data)	3	3	2
AB	102	**SG** (Signal Ground)	5	5	7

No other pins are used.

Console Port to 9-Pin DTE Port on PC

Switch's 9-Pin Serial Port	Null Modem			PC's 9-Pin DTE Port
2 RXD	<---------	TXD	----------	3 TXD
3 TXD	----------	RXD	---------->	2 RXD
5 SGND	----------	SGND	----------	5 SGND

No other pins are used.

Console to 25-Pin DTE Port on PC

Switch's 9-Pin Serial Port	Null Modem			PC's 25-Pin DTE Port
2 RXD	<---------	TXD	----------	2 TXD
3 TXD	----------	RXD	---------->	3 RXD
5 SGND	----------	SGND	----------	7 SGND

No other pins are used.

Appendix C: Specifications

Physical Characteristics

Base Unit

Ports
24 10BASE-T/100BASE-TX, with auto-negotiation

Media Slots
2 slots for optional 100BASE-FX, 1000BASE-T, 1000BASE-SX,1000BASE-LX, 2-port 1000BASE-T and 1000BASE-X with SFP slots, and 1000BASE-X GBIC modules

Network Interface
10BASE-T: RJ-45 (100-ohm, UTP cable; Categories 3, 4, 5)
100BASE-TX: RJ-45 (100-ohm, UTP cable; Category 5)
Ports 1-24: RJ-45 connectors, auto MDI/MDI-X

Communication Speed
10 and 100 Mbps

Communication Mode
Full and half duplex

Buffer Architecture
32 Mbyte per system

Aggregate Bandwidth
8.8 Gbps

Switching Database
8K MAC address entries

LEDs
System: PWR, Diag, Stack
Ports: Link/Activity

Weight
4.06 kg (6 lb 13 oz)

Size
44 x 32.4 x 4.3 cm (17.32 x 12.8 x 1.69 in.)

Temperature
Operating: 0 to 50 °C (32 to 122 °F)
Storage: -40 to 70 °C (-40 to 158 °F)

Humidity
Operating: 10% to 90%

Power Supply
Internal, auto-ranging transformer: 100 to 240 VAC, 47 to 63 Hz

Power Consumption
60 Watts maximum

Heat Dissipation
205 BTU/hr maximum

Maximum Current
3.0 A @ 110 V
2.0 A @ 240 V

Switch Features

Spanning Tree Protocol

Forwarding Mode
Store-and-forward

Throughput
Wire speed

Flow Control
Full Duplex: IEEE 802.3x
Half Duplex: Back pressure

Broadcast Storm Suppression
Traffic throttled above a critical threshold

VLAN Support
Up to 256 groups; port-based or with 802.1Q VLAN tagging,
GVRP for automatic VLAN learning, private VLANs

Multicast Switching
IGMP Snooping

Quality of Service
Supports four levels of priority and Weighted Round Robin Queueing

(which can be configured by VLAN tag or port),
Layer 3/4 priority mapping: IP Precedence, IP DSCP

Management Features

In-Band Management
Telnet, or SNMP manager

Out-of-Band Management
RS-232 DB-9 console port

Software Loading
TFTP in-band, or XModem out-of-band

MIB Support
MIB II (RFC1213), Bridge MIB (RFC 1493, without Static Table)

Standards

IEEE 802.3 Ethernet, IEEE 802.3u Fast Ethernet
IEEE 802.1p priority tags
IEEE 802.3ac VLAN tagging
IEEE 802.1D (Bridging)
IEEE 802.1w Rapid Spanning Tree Protocol
IEEE 802.3ad Link Aggregation
IEEE 802.1Q VLAN Bridge Management
IEEE 802.1x RADIUS user authentication
IEEE 802.3x full-duplex flow control
ISO/IEC 8802-3
UDP (RFC 768), IP (RFC 791), TCP (RFC793), TFTP (RFC 783), TELNET (RFC 783), SNMP (RFC 1157), MIB II (RFC 1213), Traps (RFC 1215), Bridge MIB (RFC 1493), RMON (RFC 1757), HTML (RFC 1866), HTTP (RFC 2068), RADIUS (RFC 2618)

Compliances

CE Mark

Emissions
FCC Class A
Industry Canada Class A
EN55022 (CISPR 22) Class A
EN 61000-3-2/3
VCCI Class A
C-Tick - AS/NZS 3548 (1995) Class A

Immunity
EN 61000-4-2/3/4/5/6/8/11

Safety
CSA/NRTL (CSA 22.2.950 & UL 1950)
TUV/GS (EN60950)

Slide-in Modules

100BASE-FX Extender Modules

Ports
1 100BASE-FX, SC connectors

Communication Speed
100 Mbps

Communication Mode
Full duplex

Network Interface
MS-3726-SFC: 9/125 micron single-mode fiber cable
MS-3726-MFC: 50/125 or 62.5/125 micron multimode fiber cable

Standards
IEEE 802.3u Fast Ethernet
ISO/IEC 8802-3

1000BASE-T Extender Module

Ports
1 10000BASE-T, RJ-45 connector

Communication Speed
10/100/1000 Mbps

Communication Mode
Full duplex only at 1000 Mbps
Full and half duplex at 10/100 Mbps

Network Interface
RJ-45 (100-ohm, UTP cable; Category 5, 5e, or 6)

Standards
IEEE 802.3ab Gigabit Ethernet
IEEE 802.3u Fast Ethernet
IEEE 802.3 Ethernet

1000BASE-SX Extender Module

Ports
1 1000BASE-SX SC-type port

Communication Speed
1000 Mbps

Communication Mode
Full duplex

Network Interface
SC connector: 50/125 or 62.5/125 micron multimode fiber cable

Standards
IEEE 802.3z Gigabit Ethernet

1000BASE-LX Extender Module

Ports
1 1000BASE-LX SC-type port

Communication Speed
1000 Mbps

Communication Mode
Full duplex

Network Interface
SC connector, 9/125 micron single-mode fiber

Standards
IEEE 802.3z Gigabit Ethernet

1000BASE-X GBIC Module

Ports
1 slot for GBIC transceivers

Communication Speed
1000 Mbps

Communication Mode
Full Duplex

Standards
IEEE 802.3z Gigabit Ethernet

Combo Module

Ports
1 Gigabit RJ-45 port, 1 Small Form Factor Pluggable (SFP) transceiver slot

Communication Speed
1000 Mbps

Communication Mode
Full Duplex

Network Interface
SC connector, 9/125 micron single-mode fiber

Standards
LC, MT-RJ, or SG conector, 50/125 or 62.5/125 micron multimode fiber cable
9/125 micron single-mode fiber cable

Stacking Module

Ports
2 USB Type-A ports

Glossary

10BASE-T

IEEE 802.3 specification for 10 Mbps Ethernet over two pairs of Category 3, 4, or 5 UTP cable.

100BASE-FX

IEEE 802.3u specification for 100 Mbps Fast Ethernet over two strands of 50/125 or 62.5/125 micron core fiber cable.

100BASE-TX

IEEE 802.3u specification for 100 Mbps Fast Ethernet over two pairs of Category 5 UTP cable.

1000BASE-LX

IEEE 802.3z specification for Gigabit Ethernet over one strand of 9/125 micron core fiber cable.

1000BASE-LH

Gigabit Ethernet over two strands of 9/125 micron core fiber cable.

1000BASE-SX

IEEE 802.3z specification for Gigabit Ethernet over two strands of 50/125 or 62.5/125 micron core fiber cable.

1000BASE-T

IEEE 802.3ab specification for Gigabit Ethernet over two pairs of Category 5, 5e, or 6 100-ohm UTP cable.

Auto-Negotiation

Signalling method allowing each node to select its optimum operational mode (e.g., 10, 100, or 1000 Mbps and half or full duplex) based on the capabilities of the node to which it is connected.

Bandwidth

The difference between the highest and lowest frequencies available for network signals. Also synonymous with wire speed, the actual speed of the data transmission along the cable.

Collision

A condition in which packets transmitted over the cable interfere with each other. Their interference makes both signals unintelligible.

Collision Domain

Single CSMA/CD LAN segment.

CSMA/CD

Carrier Sense Multiple Access/Collision Detect is the communication method employed by Ethernet and Fast Ethernet.

End Station

A workstation, server, or other device that does not act as a network interconnection.

Ethernet

A network communication system developed and standardized by DEC, Intel, and Xerox, using baseband transmission, CSMA/CD access, logical bus topology, and coaxial cable. The successor IEEE 802.3 standard provides for integration into the OSI model and extends the physical layer and media with repeaters and implementations that operate on fiber, thin coax and twisted-pair cable.

Fast Ethernet

A 100 Mbps network communication system based on Ethernet and the CSMA/CD access method.

Fast Ethernet Switch

Device that provides a full 100 Mbps bandwidth (or either 10 or 100 Mbps bandwidth with Auto-Negotiation) to each port (LAN segment).

Full Duplex

Transmission method that allows switch and network card to transmit and receive concurrently, effectively doubling the bandwidth of that link.

Gigabit Ethernet

A 1000 Mbps network communication system based on Ethernet and the CSMA/CD access method.

IEEE 802.3

Defines carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

IEEE 802.3ab

Defines CSMA/CD access method and physical layer specifications for 1000BASE-T Gigabit Ethernet.

IEEE 802.3u

Defines CSMA/CD access method and physical layer specifications for 100BASE-TX Fast Ethernet.

IEEE 802.3x

Defines Ethernet frame start/stop requests and timers used for flow control on full-duplex links.

IEEE 802.3z

Defines CSMA/CD access method and physical layer specifications for 1000BASE Gigabit Ethernet over fiber cable.

LAN Segment

Separate LAN or collision domain.

LED

Light emitting diode used for monitoring a device or network condition.

Link Segment

Length of twisted-pair or fiber cable joining a pair of repeaters or a repeater and a PC.

Local Area Network (LAN)

A group of interconnected computer and support devices.

Media Access Control (MAC)

A portion of the networking protocol that governs access to the transmission medium, facilitating the exchange of data between network nodes.

MIB

An acronym for Management Information Base. It is a set of database objects that contains information about the device.

Network Diameter

Wire distance between two end stations in the same collision domain.

RJ-45 Connector

A connector for twisted-pair wiring.

Switched Ports

Ports that are on separate collision domains or LAN segments.

Transmission Control Protocol/Internet Protocol (TCP/IP)

Protocol suite that includes TCP as the primary transport protocol, and IP as the network layer protocol.

UTP

Unshielded twisted-pair cable.

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